

JAN 21 2009

PATENT APPLN. NO. 10/646,810
RESPONSE UNDER 37 C.F.R. §1.111

PATENT
NON-FINAL

IN THE CLAIMS:

1. (currently amended) A lithium secondary battery comprising a positive electrode which is capable of occluding and releasing lithium, a negative electrode which is capable of occluding and releasing lithium and comprising carbon as a negative electrode active material, a separator between the positive electrode and the negative electrode, and a nonaqueous electrolyte comprising a solute, a nonaqueous solvent and a wettability improving agent,

wherein the nonaqueous solvent does not have substantial wettability to the separator,

the wettability improving agent is dissolved in the nonaqueous solvent, improves wettability of the nonaqueous solvent to the separator, and has an oxidative decomposition potential in a range of 4.5 V to 6.2 V based on the potential of a lithium reference electrode, and a mass ratio of the wettability improving agent relative to the nonaqueous solvent is not greater than 3 mass %,
and

the separator comprises polyethylene,

the solute of the electrolyte is a lithium containing salt, the solvent of the electrolyte comprises a mixture of ethylene carbonate and γ -butyrolactone and the wettability improving agent

is selected from the group consisting of 1,3-dioxolane (DOL), 4-methyl-1,3-dioxolane (4-MeDOL), N,N-dimethylformamide (DMF), N-methylpyrrolidone (NMP), methyl formate (MF) and dimethyl sulfoxide (DMSO).

2. (original) The lithium secondary battery according to claim 1, wherein the oxidative decomposition potential of the wettability improving agent is smaller than that of the nonaqueous solvent.

3. (original) The lithium secondary battery according to claim 1, wherein a reductive decomposition potential of the wettability improving agent is not greater than 0.0 V.

4. (original) The lithium secondary battery according to claim 2, wherein a reductive decomposition potential of the wettability improving agent is not greater than 0.0 V.

5 - 8. (canceled)

9. (original) The lithium secondary battery according to claim 1, wherein the oxidative decomposition potential of the

wettability improving agent is in a range of 4.8 V to 5.2 V.

10. (original) The lithium secondary battery according to claim 2, wherein the oxidative decomposition potential of the wettability improving agent is in a range of 4.8 V to 5.2 V.

11. (original) The lithium secondary battery according to claim 3, wherein the oxidative decomposition potential of the wettability improving agent is in a range of 4.8 V to 5.2 V.

12. (original) The lithium secondary battery according to claim 4, wherein the oxidative decomposition potential of the wettability improving agent is in a range of 4.8 V to 5.2 V.

13 - 17. (canceled)

18. (new) A lithium secondary battery comprising a positive electrode which is capable of occluding and releasing lithium, a negative electrode which is capable of occluding and releasing lithium and comprising carbon as a negative electrode active material, a separator between the positive electrode and the negative electrode, and a nonaqueous electrolyte comprising a

solute, a nonaqueous solvent and a wettability improving agent,

wherein the nonaqueous solvent does not have substantial wettability to the separator,

the wettability improving agent is dissolved in the nonaqueous solvent, improves wettability of the nonaqueous solvent to the separator, and has an oxidative decomposition potential in a range of 4.5 V to 6.2 V based on the potential of a lithium reference electrode, and

the separator comprises polyethylene,

the solute of the electrolyte is a lithium containing salt, the solvent of the electrolyte comprises a mixture of ethylene carbonate and γ -butyrolactone and, as the wettability improving agent, N-methylpyrrolidone (NMP).

19. (new) A lithium secondary battery comprising a positive electrode which is capable of occluding and releasing lithium, a negative electrode which is capable of occluding and releasing lithium and comprising carbon as a negative electrode active material, a separator between the positive electrode and the negative electrode, and a nonaqueous electrolyte comprising a solute, a nonaqueous solvent and a wettability improving agent,

wherein the nonaqueous solvent does not have substantial

wettability to the separator,

the wettability improving agent is dissolved in the nonaqueous solvent, improves wettability of the nonaqueous solvent to the separator, and has an oxidative decomposition potential in a range of 4.5 V to 6.2 V based on the potential of a lithium reference electrode, and

the separator comprises polyethylene,

the solute of the electrolyte is a lithium containing salt, the solvent of the electrolyte comprises a mixture of ethylene carbonate and γ -butyrolactone and, as the wettability improving agent, methyl formate (MF).

20. (new) The lithium secondary battery according to claim 18 or 19, wherein the oxidative decomposition potential of the wettability improving agent is smaller than that of the nonaqueous solvent.

21. (new) The lithium secondary battery according to claim 18 or 19, wherein a reductive decomposition potential of the wettability improving agent is not greater than 0.0 V.

22. (new) The lithium secondary battery according to

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claim 18 or 19, wherein a mass ratio of the wettability improving agent relative to the nonaqueous solvent is not greater than 3 mass %.

23. (new) The lithium secondary battery according to claim 18 or 19, wherein the oxidative decomposition potential of the wettability improving agent is in a range of 4.8 V to 5.2 V.